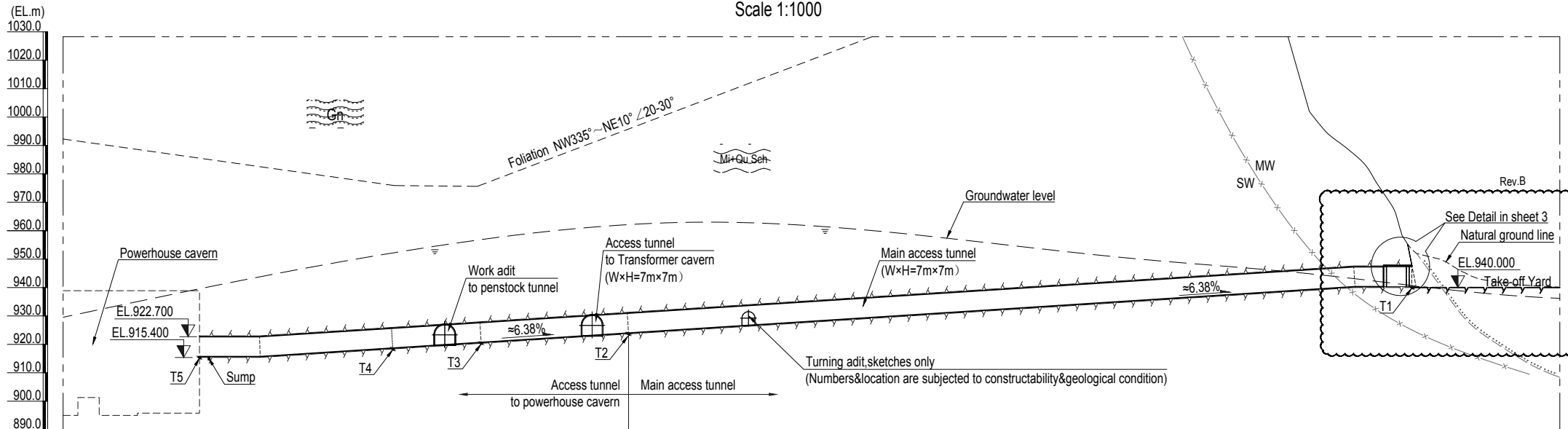
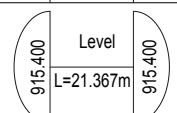
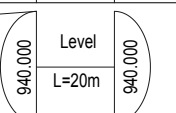


## LONGITUDINAL PROFILE OF ACCESS TUNNEL (TO POWERHOUSE CAVERN)

Scale 1:1000



Chainage (m)	CP0+151.143		CP0+129.776		CP0+083.090		CP0+051.910		CP0+000.000		CH0+275.873						CH0+020.000		CH0+000.000								
Vertical alignment					918.378		920.367		923.678																		
Distance (m)	E.P.	427.016	420	400	380	358.963	340	327.783	320	300	280	275.873	260	240	220	200	180	160	140	120	100	80	60	40	20	00	B.P.
Assumed rock classification	II														III												
Support type	Support type of class II														Support type of class III												
Overlying rock thickness	294m ~ 402.8m														7.7m ~ 294m												

## TUNNEL SUPPORT PATTERN

Rock mass quality	40≥Q	10≤Q<40	4≤Q<10	1≤Q<4		Q<1
Support type	I	II	III	IV (Without steel support)	IV (With steel support)	V Same as type IV (With steel support)
Inner dimension(m)	W=7m, H=7m					
	Excavation Parameter					
ESR	1.3	1.3	1.3	1.3		1.3
Excavation span(m)	3	3	2	1.5		0.5~1
Calculated MUS*(m)	11	9	5	3		1
MUS* for shotcrete application(m)		9	2	1.5		1
MUS* for rock dowel installation(m)		6	4	3		0.5~1
MUS* for steel support installation(m)				0.5~1.0		0.5~1
Excavation method	Blasting			Blasting/mechanically		Mechanically
Initial support parameters						
Weep hole Φ50mm,L=0.5m / 0.8m	where necessary					
Plastic fiber shotcrete,f <sub>c</sub> =25MPa	T=50mm	T=50mm	T=100mm	T=100mm	T=160mm	For class V rock, the same support scheme as class IV rock can be adopted after grouting is used to improve the integrity and firmness of surrounding rock.
Rock dowel D25,L=3m,alternately	Spot	@2.5m×2.5m	@2m×2m	@1.5m×1.5m	@1.0m×1.0m	
Steel support, MB150 (or lattice girder)					@1m	
Forepoling grouted dowel,D25mm, @400mm, L=6m					where necessary	
*MUS . Maximum Unsupported Span.						

## NOTE

- All dimensions are in millimeters, and coordinates, chainages & elevations are in meters.
- The excavation and support methods can be adjusted according to the actual situation after the geological conditions are revealed.
- It is evident that the maximum unsupported span is a guideline, only, and needs continuous adjustment to the prevailing rock conditions and construction requirements at the spot.
- The cylinder specified compressive strength of tunnel shotcrete and cement mortar at 28 days of age is 25MPa.
- The specified compressive strength of concrete is the cylinder strength at age of 28 days.
- The yield strength and of steel is 250MPa.
- Rust preventive compound will be sprayed on exposed surface of steel structure.
- Symbol description:  
A-Line is the design excavation line.  
B-Line is the overbreak line.  
R denotes round bar, yield strength of the round bar is 280MPa.  
D denotes deformed bar, yield strength of the deformed bar is 500MPa;
- The forepoling is mainly used in the tunnel section with poor surrounding rock geology, which should be used together with dowel and steel support (or lattice girder), and the spacing of dowel should be consistent with that of steel support.
- The detail of weep holes, rock dowel, steel support and steel lattice girder see the drawing No. UT1-C-000-CVL-DG-40001.
- The end position of the access tunnel may be adjusted according to the final design of the powerhouse.
- The steel support (or lattice girder) to rock class V / IV is subjected to the exposed geological condition.
- See subsequent drawings for concrete structure and reinforcement.

Scale:

1:1000 0 10 20 30 40 50m

## REFERENCE DRAWINGS

UT1-C-000-CVL-DG-40001	DETAILED DESIGN DRAWING OF EXCAVATION AND SUPPORT FOR UNDERGROUND CAVERN
UT1-C-090-CVL-DC-64001	SURROUNDING ROCK STABILITY CALCULATION OF ACCESS TUNNEL FOR POWERHOUSE
UT1-C-090-CVL-DG-64001	LAYOUT OF ACCESS TUNNEL TO POWERHOUSE

## SYMBOL AND LEGEND

## FOR APPROVAL

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PROJECT TITLE

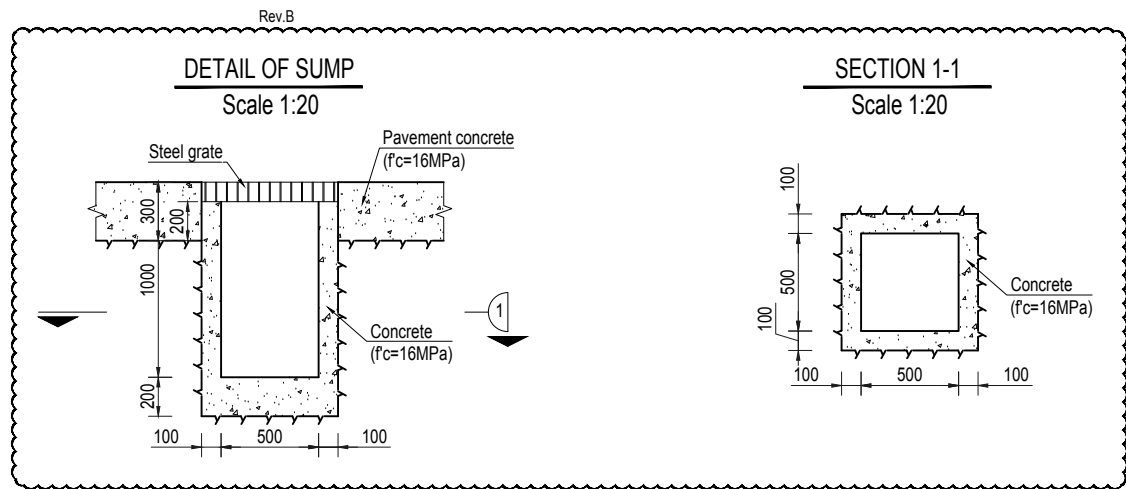
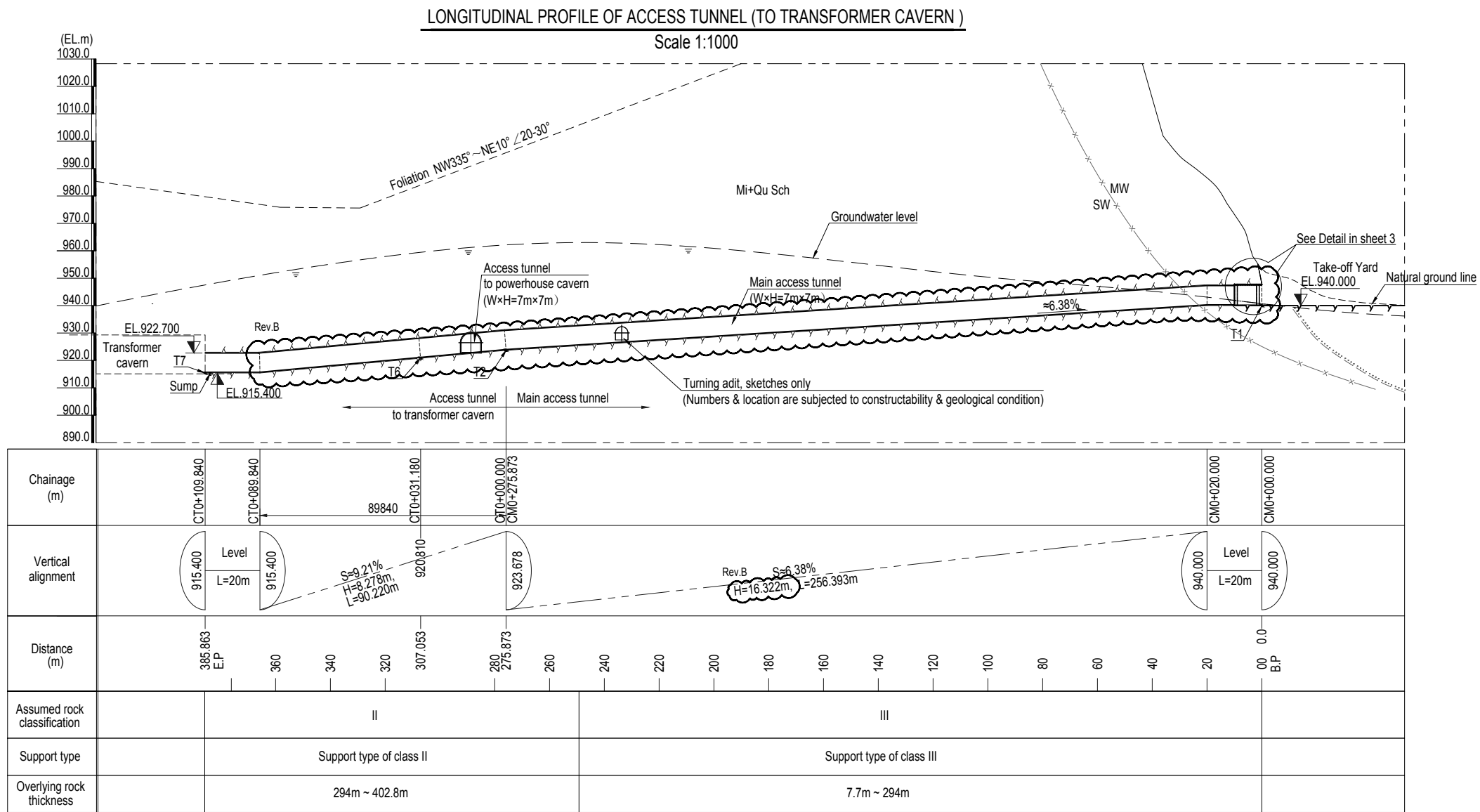
Upper Trishuli-1 HEP (216MW)

OWNER  
NWEDC  
NEPAL WATER AND ENERGY DEVELOPMENT CO. (PVT.) LTD.OWNER'S ENGINEER  
TRACTEBEL  
ENGIE  
jade CONSULTCONTRACTOR  
DOOSAN Enerbility

DRAWING TITLE

EXCAVATION AND SUPPORT OF ACCESS TUNNEL  
TO POWERHOUSE ( 1 / 6 )

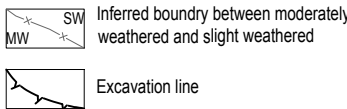
INDEX	DRAWING NUMBER	SHEET NO.	REV. NO.
A	UT1-C-090-CVL-DG-64002- 01	1 OF 6	0B



NOTE

1. All dimensions are in millimeters, and coordinates, chainages & elevations are in meters.

LEGEND:



Scale:  
1:1000 0 10 20 30 40 50m

REFERENCE DRAWINGS

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UT1-C-090-CVL-DG-64001	SURROUNDING ROCK STABILITY CALCULATION OF ACCESS TUNNEL FOR POWERHOUSE
UT1-C-090-CVL-DG-64001	LAYOUT OF ACCESS TUNNEL TO POWERHOUSE

SYMBOL AND LEGEND

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PROJECT TITLE

Upper Trishuli-1 HEP (216MW)

OWNER  
**NWEDC**  
NEPAL WATER AND ENERGY DEVELOPMENT CO. (PVT.) LTD.

OWNER'S ENGINEER  
**TRACTEBEL** **Jade CONSULT**

CONTRACTOR  
**DOOSAN Enerbility**

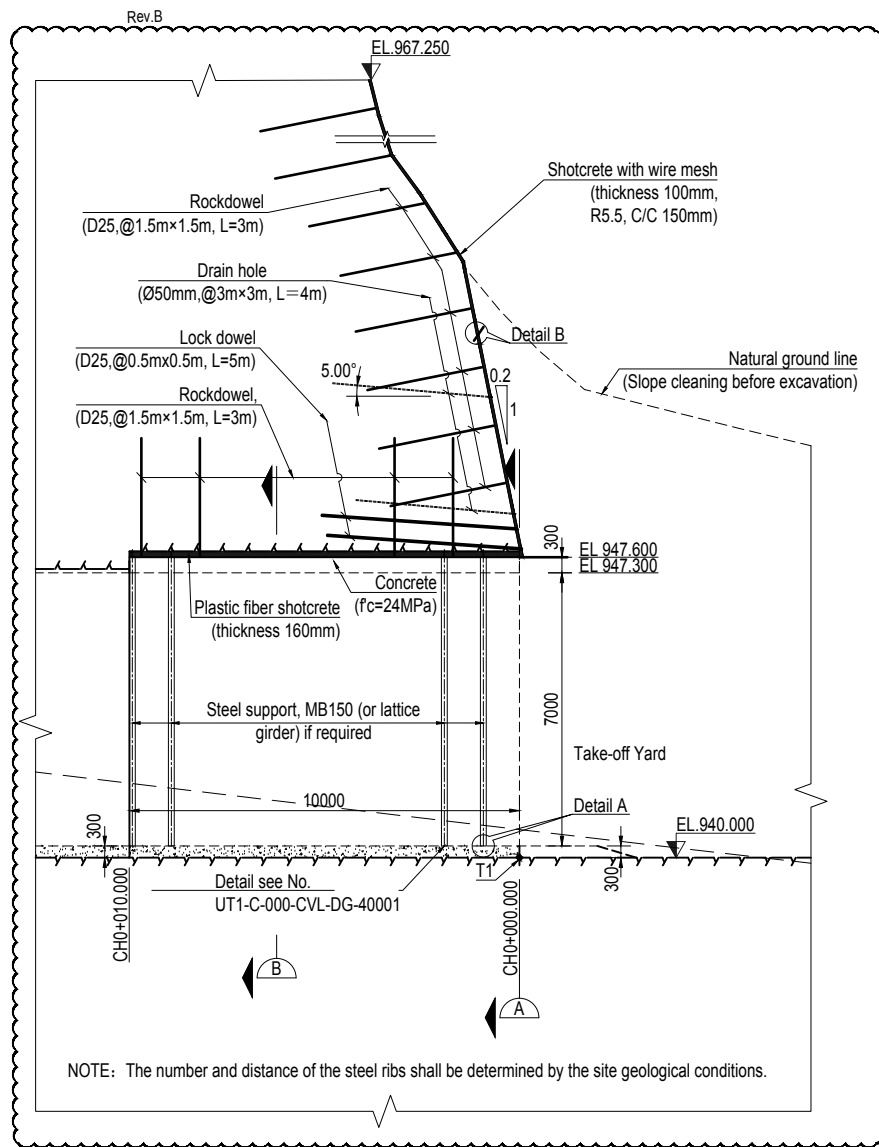
DRAWING TITLE

EXCAVATION AND SUPPORT OF ACCESS TUNNEL TO POWERHOUSE ( 2 / 6 )

INDEX	DRAWING NUMBER	SHEET NO.	REV. NO.
A	UT1-C-090-CVL-DG-64002- 02	2 OF 6	0B

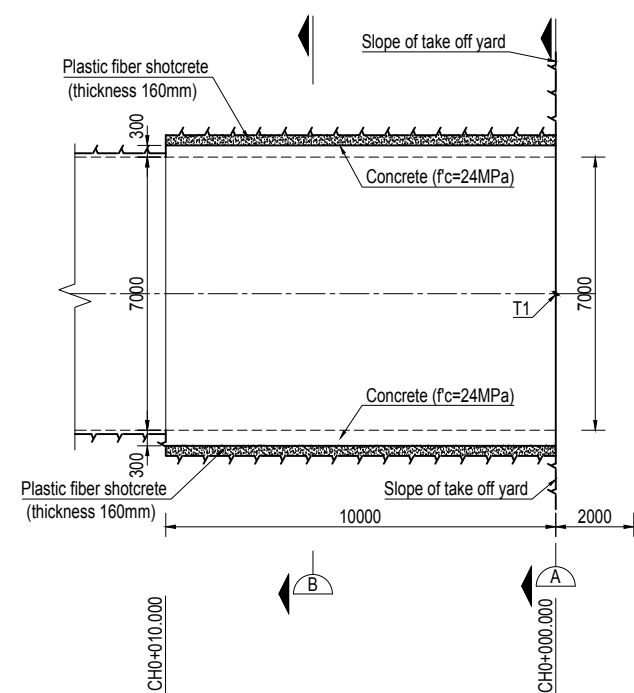
# DETAIL OF ACCESS TUNNEL PORTAL

1:100



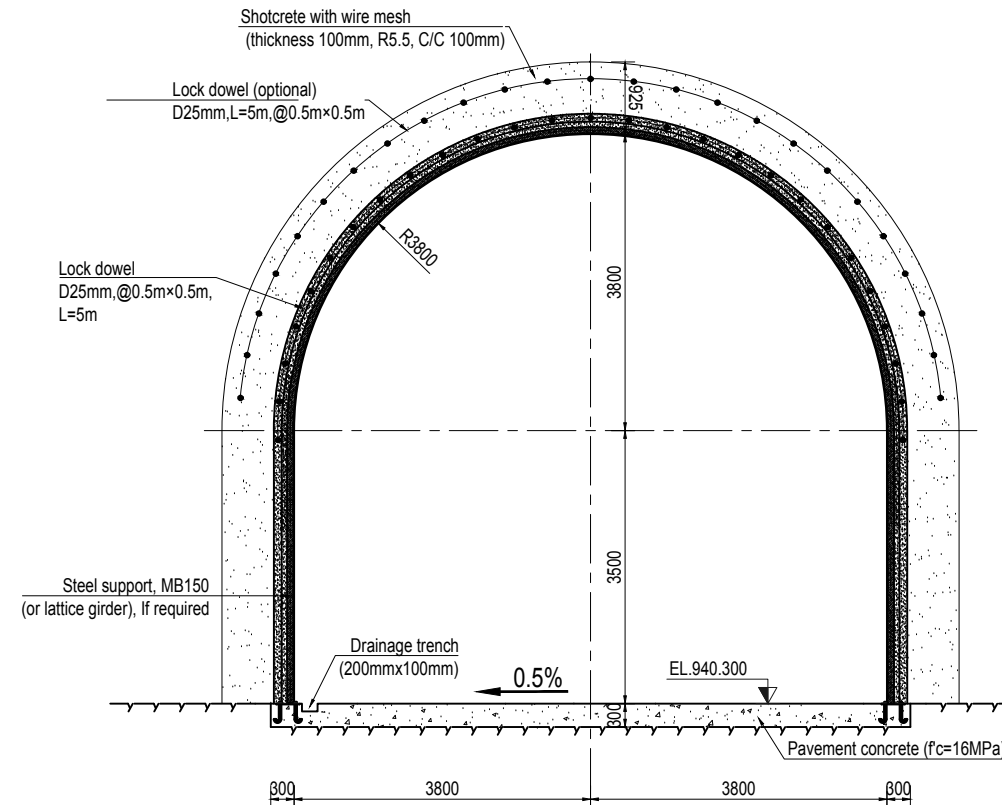
# PLAN OF ACCESS TUNNEL PORTAL

1:100



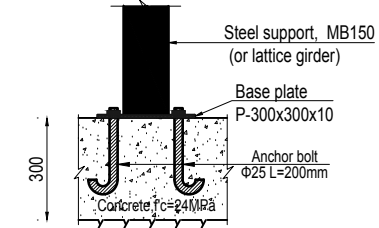
# SECTION A-A

1:50



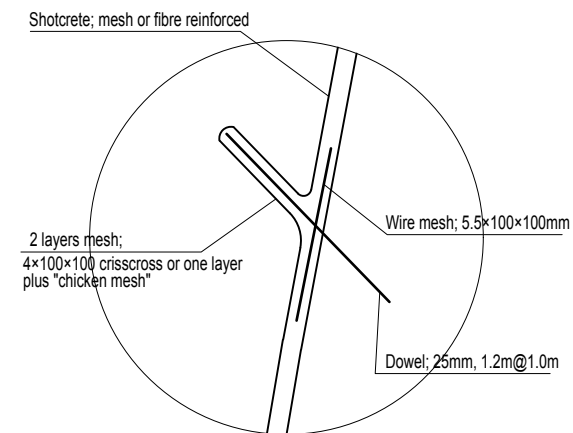
# DETAIL A

1:50



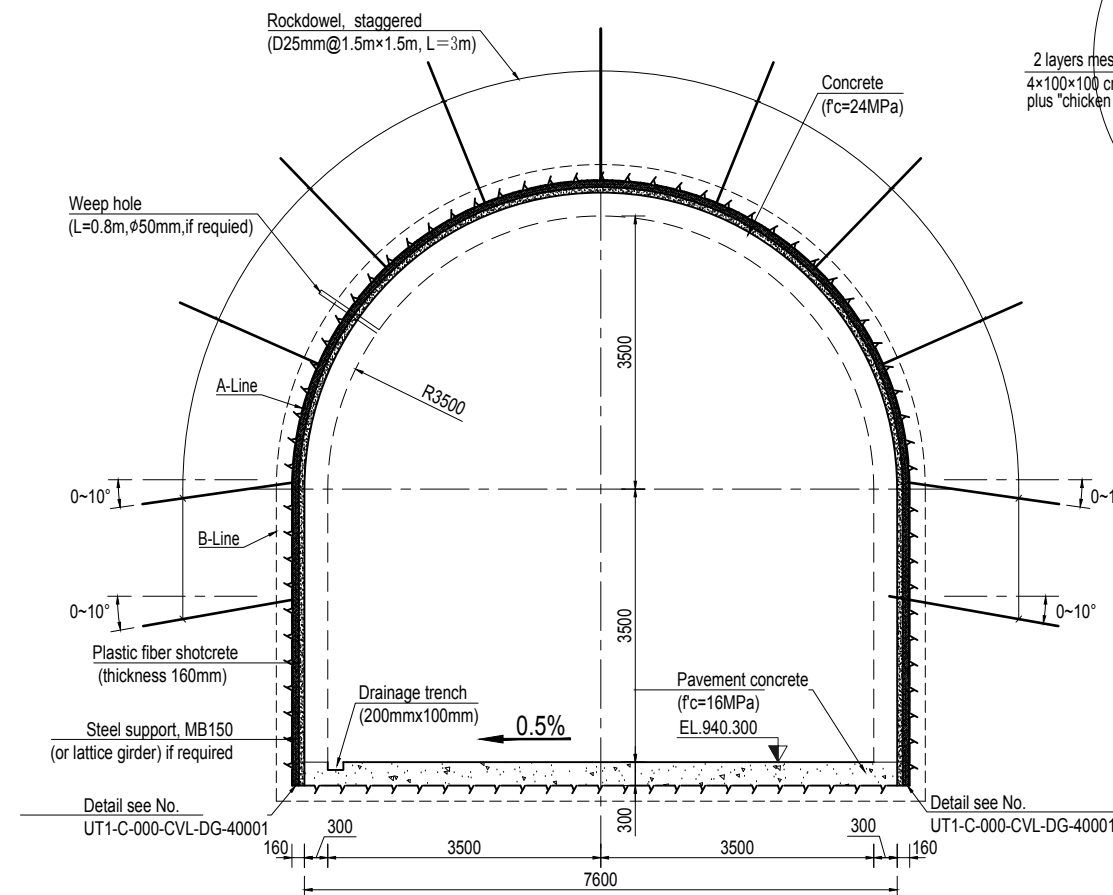
# DETAIL B

1:20



# SECTION B-B

(CH0-000.000~CH0+010.000) 1:50



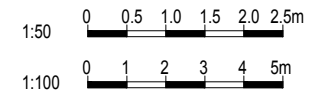
# NOTE

- All dimensions are in millimeters, and coordinates, chainages & elevations are in meters.

Legend:

Section of concrete

Scale:



# REFERENCE DRAWINGS

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PROJECT TITLE

Upper Trishuli-1 HEP (216MW)

OWNER  
NWEDC  
NEPAL WATER AND ENERGY DEVELOPMENT CO. (PVT) LTD.

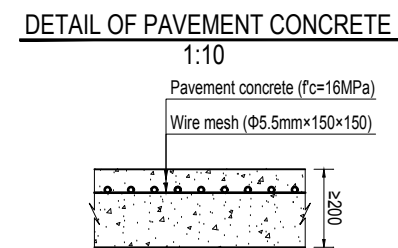
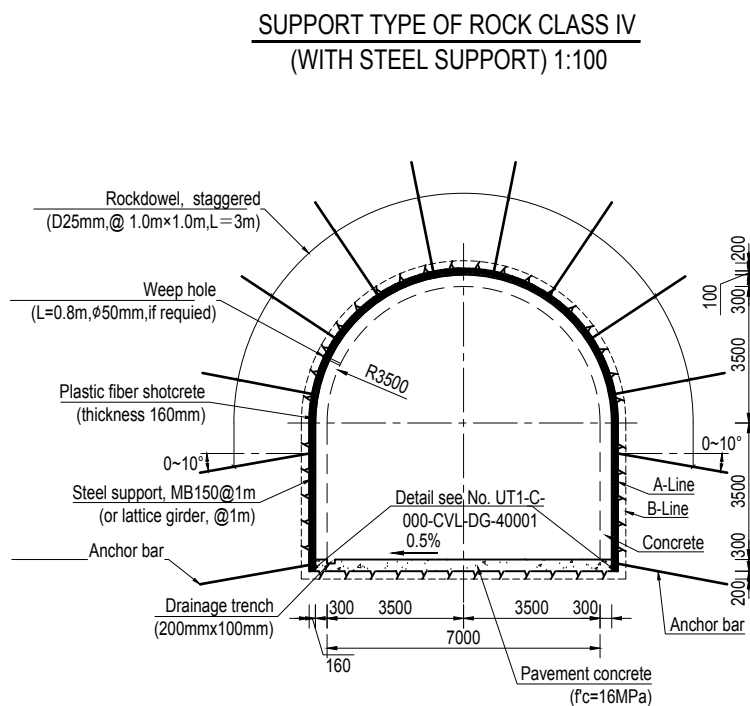
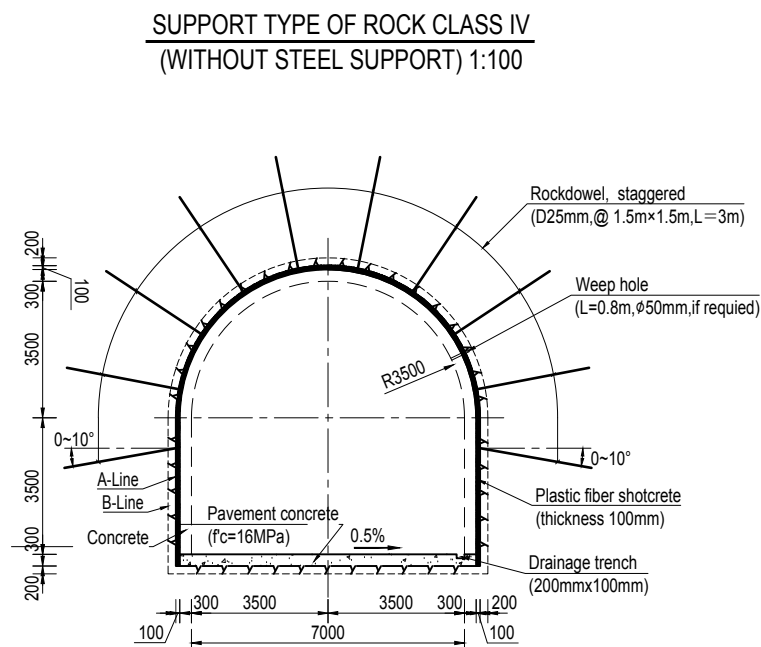
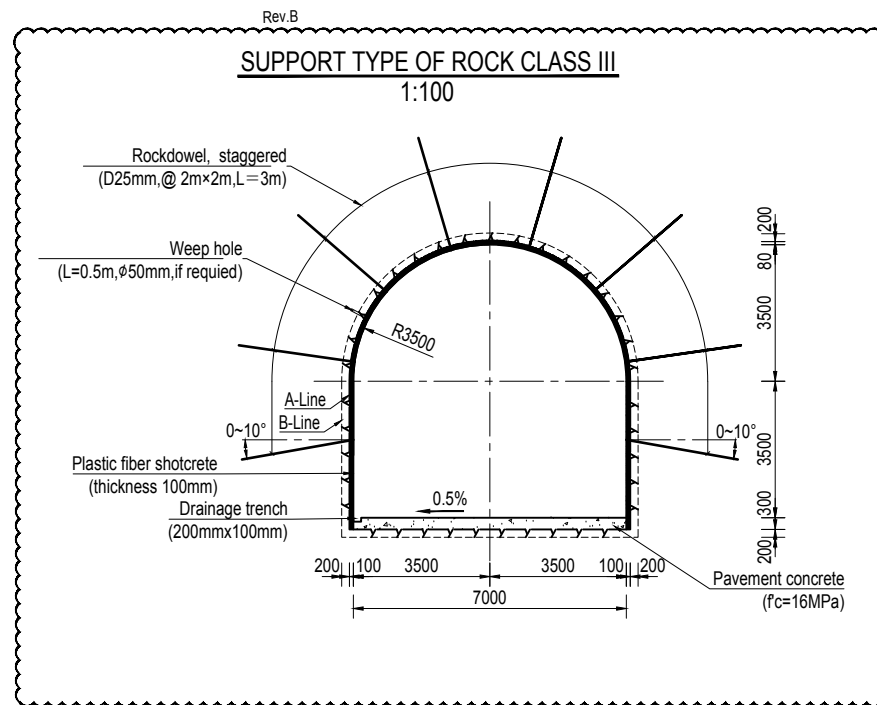
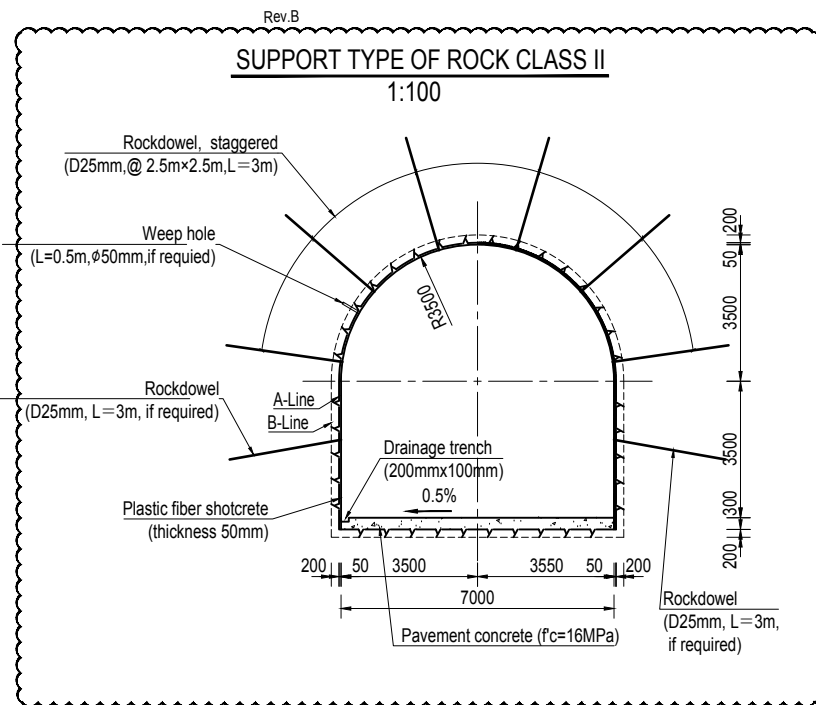
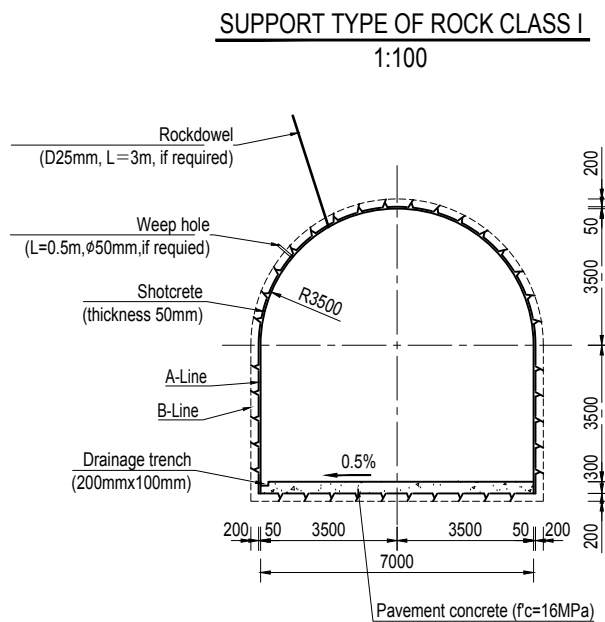
OWNER'S ENGINEER  
TRACTEBEL  
ENGIE

CONTRACTOR  
DOOSAN Enerbility

DRAWING TITLE

EXCAVATION AND SUPPORT OF ACCESS TUNNEL TO POWERHOUSE ( 3 / 6 )

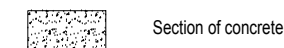
INDEX	DRAWING NUMBER	SHEET NO.	REV. NO.
A	UT1-C-090-CVL-DG-64002- 03	3 OF 6	0B



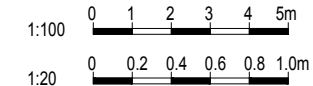
NOTE

1. All dimensions are in millimeters, and coordinates, chainages & elevations are in meters.

LEGEND:



Scale:



REFERENCE DRAWINGS

UT1-C-000-CVL-DG-40001	DETAILED DESIGN DRAWING OF EXCAVATION AND SUPPORT FOR UNDERGROUND CAVERN
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SYMBOL AND LEGEND

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PROJECT TITLE

Upper Trishuli-1 HEP (216MW)

OWNER  
**NWEDC**  
NEPAL WATER AND ENERGY DEVELOPMENT CO. PVT. LTD.

OWNER'S ENGINEER  
**TRACTEBEL** **jade**  
ENGIE CONSULT

CONTRACTOR  
**DOOSAN Enerbility**

DRAWING TITLE

EXCAVATION AND SUPPORT OF ACCESS TUNNEL TO POWERHOUSE ( 4 / 6 )

INDEX	DRAWING NUMBER	SHEET NO.	REV. NO.
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1:50

Forepoling, grouted dowel (D25mm)  
or perforated steel pipe (D60.5mm) @400mm, L=6m

Rockdowel, staggered  
(D25mm @1m×1m, L=3m)

Plastic fiber shotcrete  
(thickness 200mm)

0~10°

0~10°

Rockdowel, staggered  
(D25mm @1m×1m, L=3m)

Anchor bar

Drainage trench  
(200mm×100mm)

Pavement concrete ( $f_c=16\text{MPa}$ )

0.5%

Detail see No. UT1-C-000-CVL-DG-40001

Detail see No. UT1-C-000-CVL-DG-40001

Labels in diagram:  $\phi$  of tunnel, R3500, 3500, 3500, 300, 200, 300, 200, A-Line, B-Line.

1:50

Rockdowel, staggered  
D25mm @ 1m×1m, L=3m

Forepoling, grouted dowel (D25mm)  
or perforated steel pipe (D60.5mm)  
@400mm, L=6m

Overlap length 2m

Rev.B

Weep hole, L=0.8m  
(where necessary)

Plastic fiber shotcrete  
thickness 200mm

Connection steel bar

Location of tunnel faces

Steel support, MB150@1m  
(or lattice girder, @1m)

Drive direction

Connection steel bar

Detail see No. UT1-C-000-CVL-DG-40001

A-Line

B-Line

1000 1000 1000 1000 1000 1000 1000 1000 1000 1000

200

300

160

7300


Φ of tunnel

NOTE: (1) The gaps behind the steel ribs need always be filled with shotcrete and/or concrete, not with rock blocks.  
(2) The excavation profile may need to be adjusted to a "saw-tooth profile" and size of ribs/girders may also be adjusted.

1. All dimensions are in millimeters, and coordinates, chainages & elevations are in meters.

Section of concrete

1:100



A horizontal scale bar with alternating black and white segments. It is marked with numbers 0, 1, 2, 3, 4, and 5m. The total length represents 5 meters.

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UT1-C-090-CVL-DG-64001	LAYOUT OF ACCESS TUNNEL TO POWERHOUSE

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PROJECT TITLE

Upper Trishuli-1 HEP (216MW)

OWNER



OWNER'S ENGINEER



CONTRACTOR

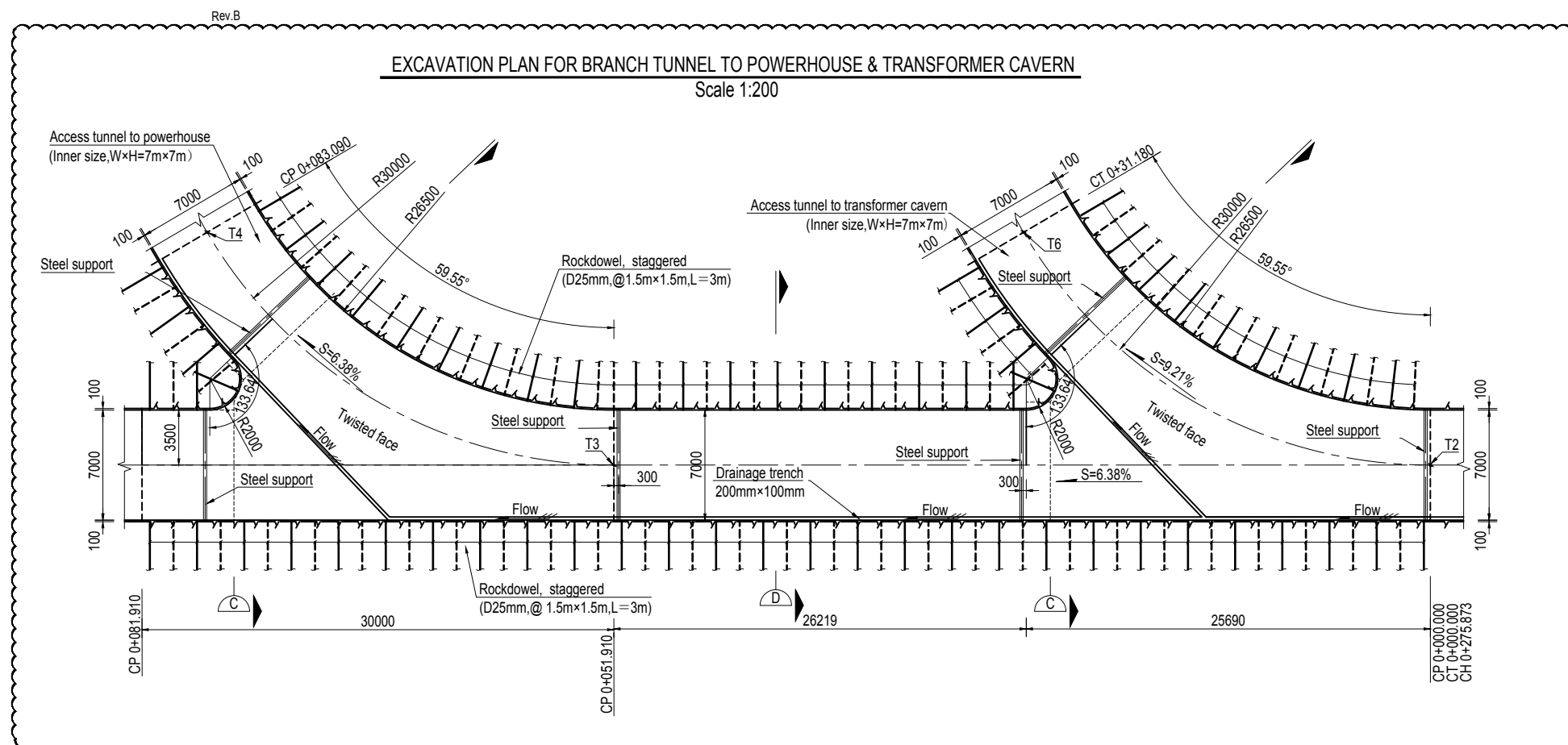
**DOOSAN** Enerbility

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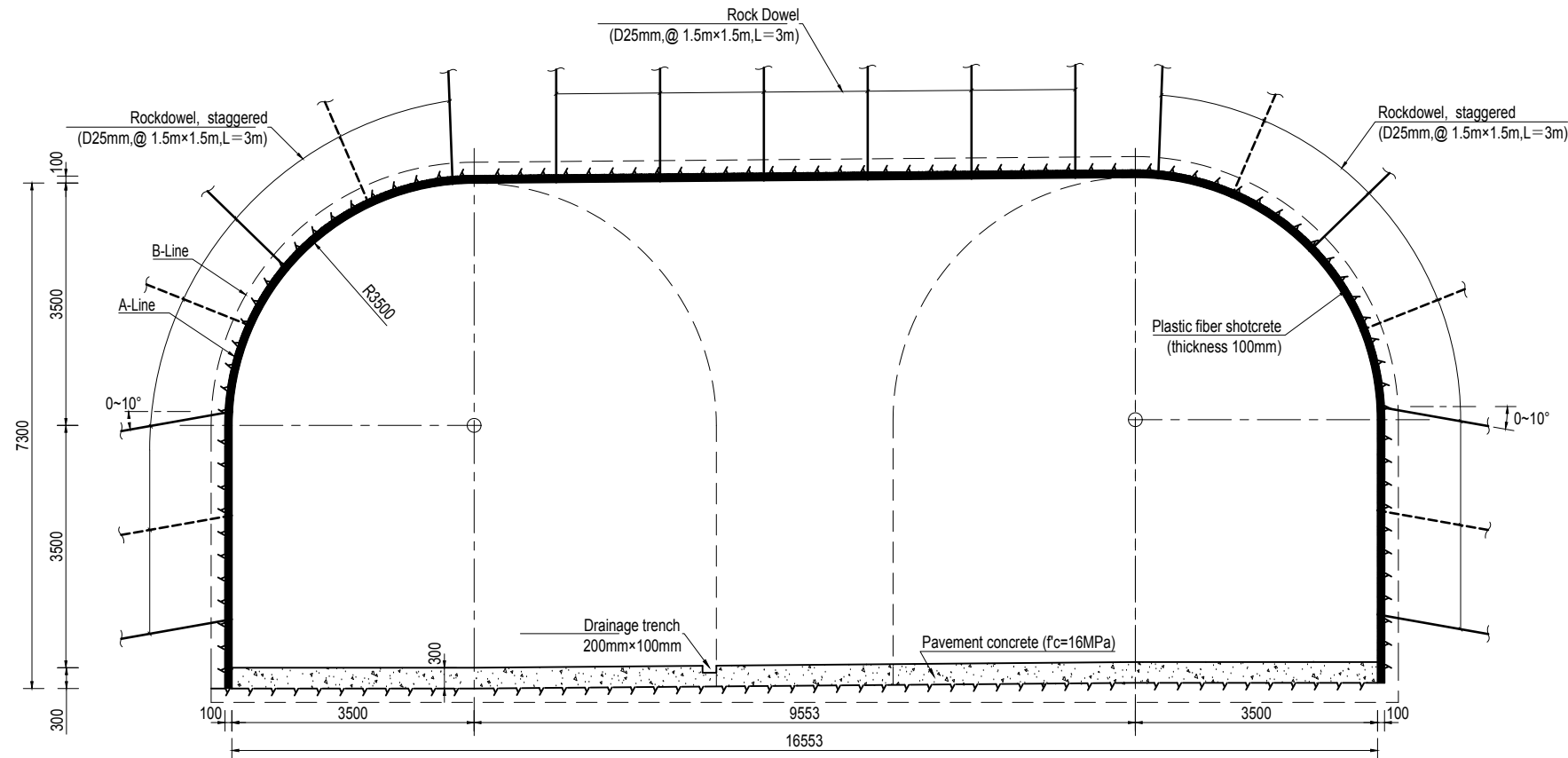
## EXCAVATION AND SUPPORT OF ACCESS TUNNEL TO POWERHOUSE ( 5 / 6 )

INDEX	DRAWING NUMBER	SHEET NO.	REV. NO.
A	UT1-C-090-CVL-DG-64002- 05	5 OF 6	0B

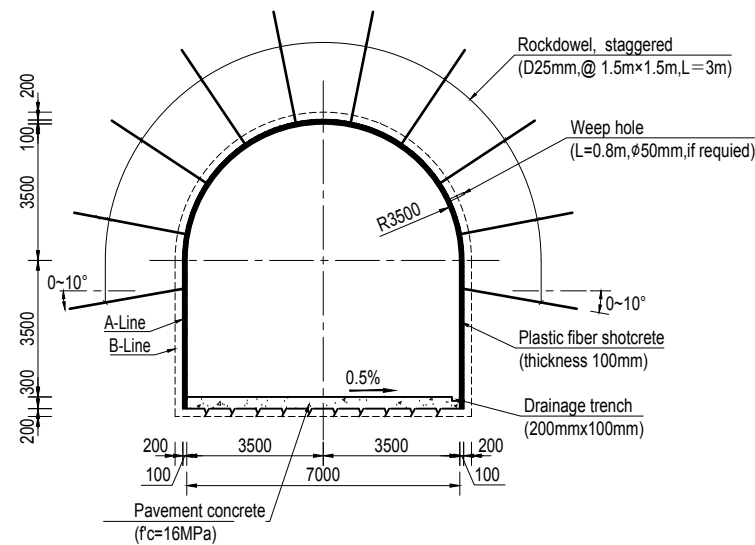
Scale 1:200



SECTION C-C  
1:50



SECTION D-D  
1:100



SAFETY INSTRUCTION:

1. THE WORKERS WHO EQUIPPED WITH THE NECESSARY SAFETY PROTECTION MEASURES SHOULD BE FAMILIAR WITH AND COMPLY WITH THE SAFETY RULES FOR CONSTRUCTION, AND MUST ADHERE THE "SAFETY FIRST, PREVENTION FIRST, COMPREHENSIVE MANAGEMENT" APPROACH, TO ENSURE SAFETY ON SITE ;
2. IT 'S FIRST THAT CHECKING THE PROCESSING EQUIPMENT IS NORMAL OPERATION OR NOT, FOR THE PRODUCTION AND THE PERSONAL SAFETY DURING STEEL PROCESSING ,THE OPERATOR SHOULD STRICTLY ABIDE BY THE SCHEDULED OPERATION PROCEDURES ;
3. IT'S REQUIREMENT THAT WELDING MACHINES ARE RELIABLE TO CONNECT GROUND, AND INSULATED CABLES ARE EQUIPPED WITH LEAKAGE PROTECTOR; IT IS STRICTLY PROHIBITED TO THE OPERATION, AND SHOULD WEAR PROTECTIVE GLASSES AND OTHER NECESSARY PROTECTIVE EQUIPMENT DURING STEEL INSTALLING;
4. SECURITY WARNING SIGNS SHOULD BE SET WHEN STEEL LIFTING, THE TEMPORARY LOCATION AND ANTI DUMPING SUPPORT SHOULD BE SAFE AND RELIABLE, SCAFFOLDING, CONSTRUCTION PLATFORM AND CHANNEL SHOULD BE BINDING ;
5. THE WORKERS SHOULD PAY ATTENTION TO THE EXISTENCE UNSAFE AREAS IN THE COURSE OF CONSTRUCTION , AND TAKE PREVENTIVE MEASURES IN TIME.

NOTE

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SYMBOL AND LEGEND

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PROJECT TITLE

Upper Trishuli-1 HEP (216MW)

OWNER



OWNER'S ENGINEER



CONTRACTOR

DOOSAN Enerbility

DRAWING TITLE

EXCAVATION AND SUPPORT OF ACCESS TUNNEL TO POWERHOUSE ( 6 / 6 )

INDEX	DRAWING NUMBER	SHEET NO.	REV. NO.
A	UT1-C-090-CVL-DG-64002- 06	6 OF 6	0B